10/24/16 "Genius is 1% inspiration and 99% perspiration." -Thomas Edison

HW: Test 3 on Friday 11/4

Quarter Test on Wednesday 11/9

AIM: What are higher order derivatives?

Warm Up:

1) What is the rate of change of position?

Velocity

2) What is the rate of change of velocity?

Acceleration.

3) What is the rate of change of acceleration?

Jerk

Higher Order Derivatives

Did you realize that it is possible to take the derivative of a derivative? We will need this ability in the study of particle motion and objects in motion, especially related to physics in the near future.

t = time

$s(t)$	**Position function**
$v(t)=s'(t)$	**Velocity function**
$a(t)=v'(t)=s''(t)$	**Acceleration function**

First derivative:	y'	$f'(x)$	$\frac{dy}{dx}$	$\frac{d}{dx}[f(x)]$	$D_x[y]$
Second derivative:	y''	$f''(x)$	$\frac{d^2y}{dx^2}$	$\frac{d^2}{dx^2}[f(x)]$	$D_x^{\,2}[y]$
Third derivative:	y'''	$f'''(x)$	$\frac{d^3y}{dx^3}$	$\frac{d^3}{dx^3}[f(x)]$	$D_x^{\,3}[y]$
Fourth derivative:	$y^{(4)}$	$f^{(4)}(x)$	$\frac{d^4y}{dx^4}$	$\frac{d^4}{dx^4}[f(x)]$	$D_x^{\,4}[y]$

EX #7: For each of the following, find the second derivative.

A.) $f(x)=\frac{3}{2}x^3+5x^2-6x+1$

$f'(x)=\frac{9}{2}x^2+10x-6$

$f''(x)=\frac{18}{2}x+10=\boxed{9x+10}$

B.) $g(x)=\frac{x^2-4x-5}{x}=\frac{x^2}{x}-\frac{4x}{x}-\frac{5}{x}=x-4-5x^{-1}$

$g'(x)=1-0+5x^{-2}=1+5x^{-2}$

$g''(x)=0-10x^{-3}=\boxed{\frac{-10}{x^3}}$

C.) $y = \dfrac{x}{x+2}$

$y' = \dfrac{(x+2)(1) - x(1)}{(x+2)^2} = \dfrac{x+2-x}{x^2+4x+4} = \dfrac{2}{x^2+4x+4}$

$y'' = \dfrac{(x^2+4x+4)(0) - 2(2x+4)}{(x^2+4x+4)^2} = \dfrac{-4x-8}{(x^2+4x+4)^2}$

D.) $f(x) = 4\sqrt{x} - \dfrac{6}{\sqrt{x}}$